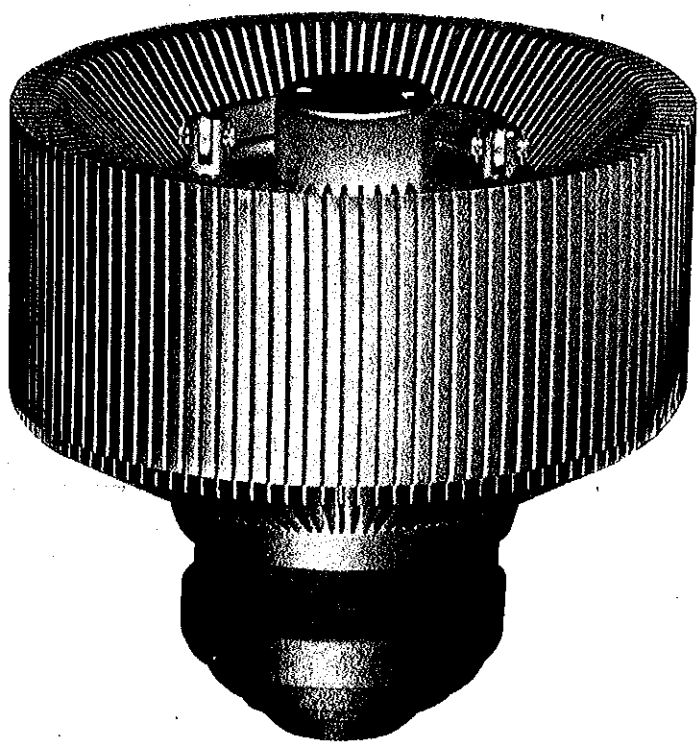
THOMSON TUBES ELECTRONIQUES

TH 354

Tetrode with Pyrobloc® Grids



- **Output power :**
  Band III
  – 10.5 kW peak-of-sync in common amplification of vision and sound carriers
  – 15 kW peak-of-sync in vision-carrier amplification
  Band I
  – 10.5 kW peak-of-sync in common amplification of vision and sound carriers
- **Excellent linearity**
- **Great stability, due to the use of Pyrobloc® pyrolytic-graphite grids**
- **Anode dissipation up to 12 KW, with forced-air cooling**

The TH 354 is a ceramic-metal, forced-air cooled transmitting tetrode of coaxial structure. It can be used in RF power amplifiers of frequencies up to 300 MHz.

It is especially intended for use in VHF-TV transmitters and translators operating in Bands I and III.

Supersedes TEG 2409

GENERAL CHARACTERISTICS

Electrical (1)

Type of cathode	Thoriated tungsten	
Type of heating	Direct, DC (2) or single-phase AC	
Heater voltage and current	See page 5	
Heating surge current	See page 5	
Interelectrode capacitances :		
cathode - control grid	83	pF
cathode - anode	0.12	pF
control grid - screen grid	135	pF
control grid - anode	0.8	pF
screen grid - anode	17	pF
Amplification factor g1-g2, average	5.5	
Transconductance (I_a = 1.5 A ; V_{g2} = 500 V)	60	mA/V

Mechanical

Operating position		Vertical
Anode cooling (3)		Forced air
Minimum air flow	13	m^3/min
Corresponding pressure drop	9	mbar
Maximum inlet-air temperature	45	°C
Maximum outlet-air temperature	100	°C
Maximum temperature at any point of both insulator ceramics and ceramic-metal seals (4)	250	°C
Net weight, approx.	7.5	kg
Dimensions	See outline drawing	

OPERATING CONDITIONS

Maximum Ratings (5) (All potentials referenced to the cathode)

Frequency	300	MHz
Anode dc voltage	7	kV
Control-grid dc bias voltage	–200	V
Screen-grid dc voltage	800	V
Maximum heating surge current	300	A
Peak cathode current	30	A
Anode direct current	6	A
Anode dissipation	12	kW
Control-grid dissipation	50	W
Screen-grid dissipation	150	W

(1) For applying the different voltages, see the instructions on page 5.

(2) For DC heating, consult THOMSON TUBES ELECTRONIQUES.

(3) Radiator only, for an inlet-air temperature of 25 °C, an anode dissipation of 12 kW, and at sea level. When the tube is installed in the cavity, the cooling characteristics are different. See the cavity data sheet or consult THOMSON TUBES ELECTRONIQUES.

(4) This temperature is the absolute limiting value ; this means that it must not be exceeded whatever the operating conditions may be (frequency, ambient air temperature, altitude). See paragraph "Particular Operating Instructions", page 4.

(5) Absolute limiting values. No one value to be exceeded, even under transient conditions. Operating at more than one limiting value at the same time may cause tube damage.

AMPLIFIER FOR TV TRANSMITTERS

Values given for vision-only operation in Band III

Typical operation (CCIR B standard at black level)

Frequency	174	MHz
–1 dB bandwidth	8	MHz
Operating heater voltage (6)	6.6	V
Anode voltage	6	kV
Screen-grid voltage	600	V
Anode current at zero signal	1.2	A
Anode current	3.3	A
Control-grid current	3	mA
Screen-grid current	30	mA
Gain	16.2	dB
Peak-of-sync output power (7)	15	kW
Average output power (7)	8.9	kW

LINEAR RF AMPLIFIER FOR TV TRANSMITTERS AND TRANSLATORS

common amplification of vision and sound carriers in Band III,
sound carrier 10 dB below the vision reference level

Typical operation (CCIR B standard at black level + sound)

Frequency	174	MHz
–1 dB bandwidth	8	MHz
Operating heater voltage (6)	6.6	V
Anode voltage	6	kV
Screen-grid voltage	600	V
Anode current at zero signal	1.35	A
Anode current	3.0	A
Control-grid current	2	mA
Screen-grid current	22	mA
Gain	16.2	dB
Peak-of-sync output power (7)	10.5	kW
Sound output power (7)	1050	W
Average output power (7)	7.3	kW
Intermodulation ratio (8)	–54	dB

(6) Measured at the cavity input

(7) At the cavity output

(8) Third-order IMD ratio measured using a three-tone test, with :
a - a reference level at peak power
b - a vision carrier 8 dB below the reference level,
c - a sound carrier 10 dB below the reference level,
d - a third signal 16 dB below the reference level,
e - 5.5 MHz difference between the vision and sound-carrier frequencies,
f - the frequency of the third signal varied over the full range between the vision and the sound carriers
g - and a third-order IMD ratio at the input, measured under the same conditions, equal to or greater than 70 dB.

AMPLIFIER FOR TV TRANSMITTERS

common amplification of vision and sound carrier in Band I,
sound carrier 10 dB below the vision reference level

Typical operation (CCIR B standard at black level + sound)

Frequency	55	MHZ
–1 dB bandwidth	6.7	MHz
Operating heater voltage (6)	6.6	V
Anode voltage	5.8	kV
Screen-grid voltage	600	V
Anode current at zero signal	1.2	A
Anode current	3.2	A
Control-grid current	3	mA
Screen-grid current	15	mA
Gain	15.4	dB
Peak-of-sync output power (7)	10.5	kW
Sound output power (7)	1050	W
Average output power (7)	7.3	kW
Intermodulation ratio (8)	–54	dB

(6) Measured at the cavity input

(7) At the cavity output

(8) Third-order IMD ratio measured using a three-tone test, with :
a - a reference level at peak power,
b - a vision carrier 8 dB below the reference level,
c - a sound carrier 10 dB below the reference level,
d - a third signal 16 dB below the reference level,
e - 5.5 MHz difference between the vision and sound carrier frequencies,
f - the frequency of the third signal varied over the full range between the vision and the sound carriers,
g - and a third-order IMD ratio at the input, measured under the same conditions, equal to or greater than 70 dB.

PARTICULAR OPERATING INSTRUCTIONS

Handling and Mounting

Since shocks and vibrations can damage the tube, any unnecessary handling should be avoided. The tube must be stored where it is protected from shocks, dust and humidity, e.g. inside its packing.

Electrode Terminal Cooling

The cooling of the tube electrode terminals requires a maximum air inlet temperature of 45 °C.
The temperature of both the ceramic insulators and the ceramic metal seals should be kept below the maximum value of 250 °C, since this is the final limiting factor for the tube. This temperature can be checked using temperature-sensitive paint, before the equipment design and air-cooling arrangements are finalized.

IMPORTANT
ALL COOLING MUST BE APPLIED BEFORE OR SIMULTANEOUSLY WITH THE APPLICATION OF ELECTRODE VOLTAGES AND MUST BE MAINTAINED FOR AT LEAST 3 MINUTES AFTER ALL VOLTAGES ARE REMOVED, TO ALLOW FOR TUBE COOL-DOWN.

Verification Before Installation

Before putting a tube into service, check with an ohmmeter the continuity of the filament and the absence of short circuit between the electrodes.

Heater Voltage

- *Heater Voltage Measurement*

The heater voltage has to be measured directly at the entrance of the cavity by means of a class 1 ferromagnetic, thermal or digital voltmeter indicating true RMS.

- *Permanent Blackheating Voltage*

In order to obtain a maximum lifetime from the tube, the heater voltage must imperatively be applied continuously, even during transmitter off-time. During these intervals, the heater voltage can be reduced to 1.7 V ± 5 % and the anode, screen-grid, and electrode terminal cooling can be cut off, provided that air can circulate freely around the tube base to supply convection cooling.

- *Operating Heater Voltage*

The operating heater voltage depends on the specific tube operating conditions : these conditions should be conveyed to THOMSON TUBES ELECTRONIQUES which will define the voltage value to be used. This value must be observed within a ± 2 % margin.
For designing the power supply, the heating current is approximately 140 A for a 7 V heater voltage. The heating surge current must not be allowed to exceed 300 A peak on the first cycle.

Application of Electrode Voltages

In general, the tube being under permanent blackheating voltage, apply successively :

1 - Ventilation
2 - The heater voltage, as explained above
3 - Wait 10 sec
4 - Control-grid bias voltage
5 - Anode voltage
6 - Screen-grid voltage
7 - RF driving voltage.

In case of installation of a new tube, apply the permanent blackheating voltage for at least 10 minutes before applying the other voltages as indicated above.
When the transmitter is switched off, the various voltages are cut off by proceeding in the reverse order of the "application of electrode voltages" above.

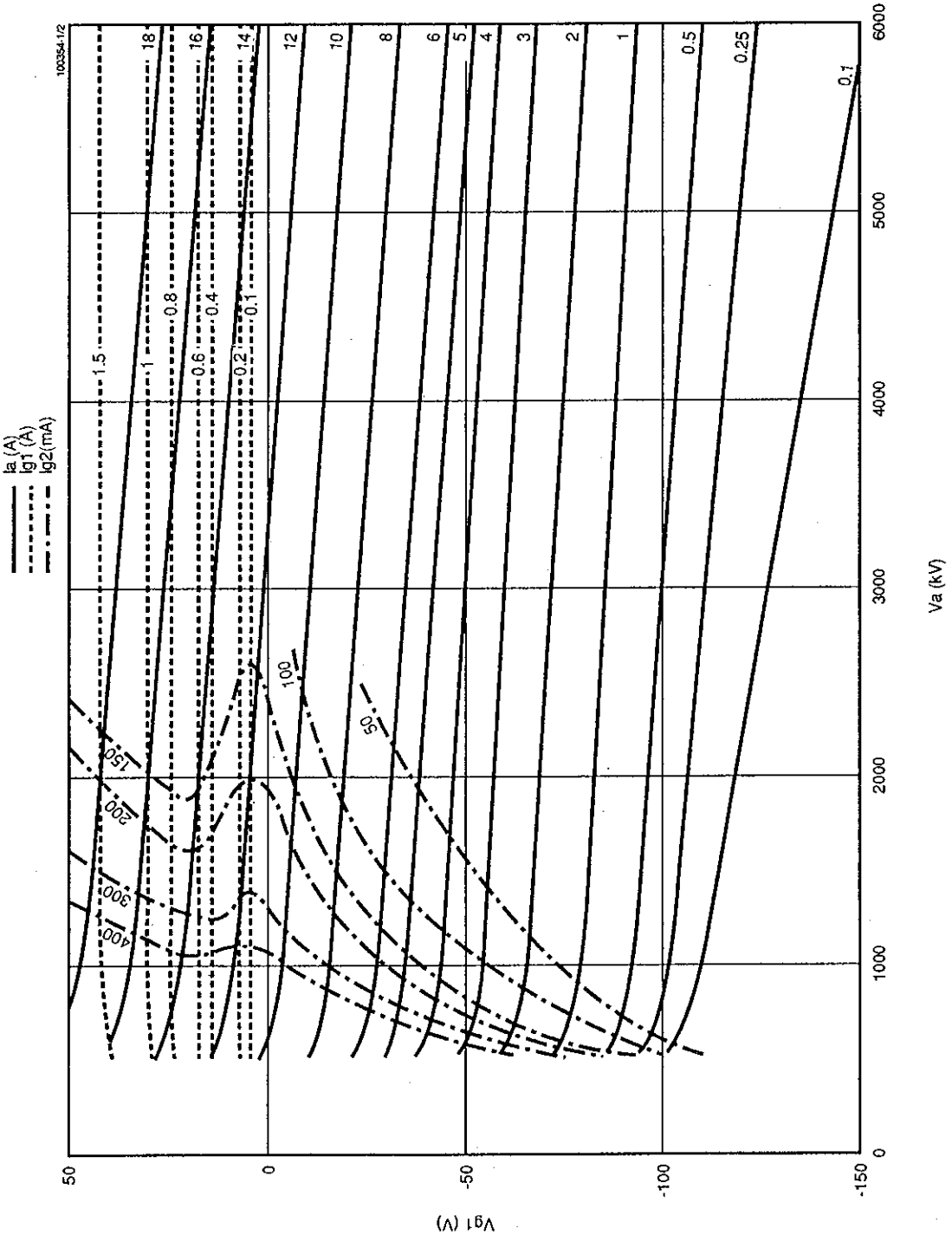
Protection Against Overcurrents

The tube should be protected against overcurrents by means of three relays, inserted in series in the control-grid, screen-grid, and anode circuits, respectively. These relays are adjusted to operate when a current equal to 1.5 $I_{max.}$ Is reached, $I_{max.}$ being the maximum current drawn under normal operating conditions. When one of these relays operates, the RF driving voltage and the screen-grid and anode voltages must be cut off simultaneously.

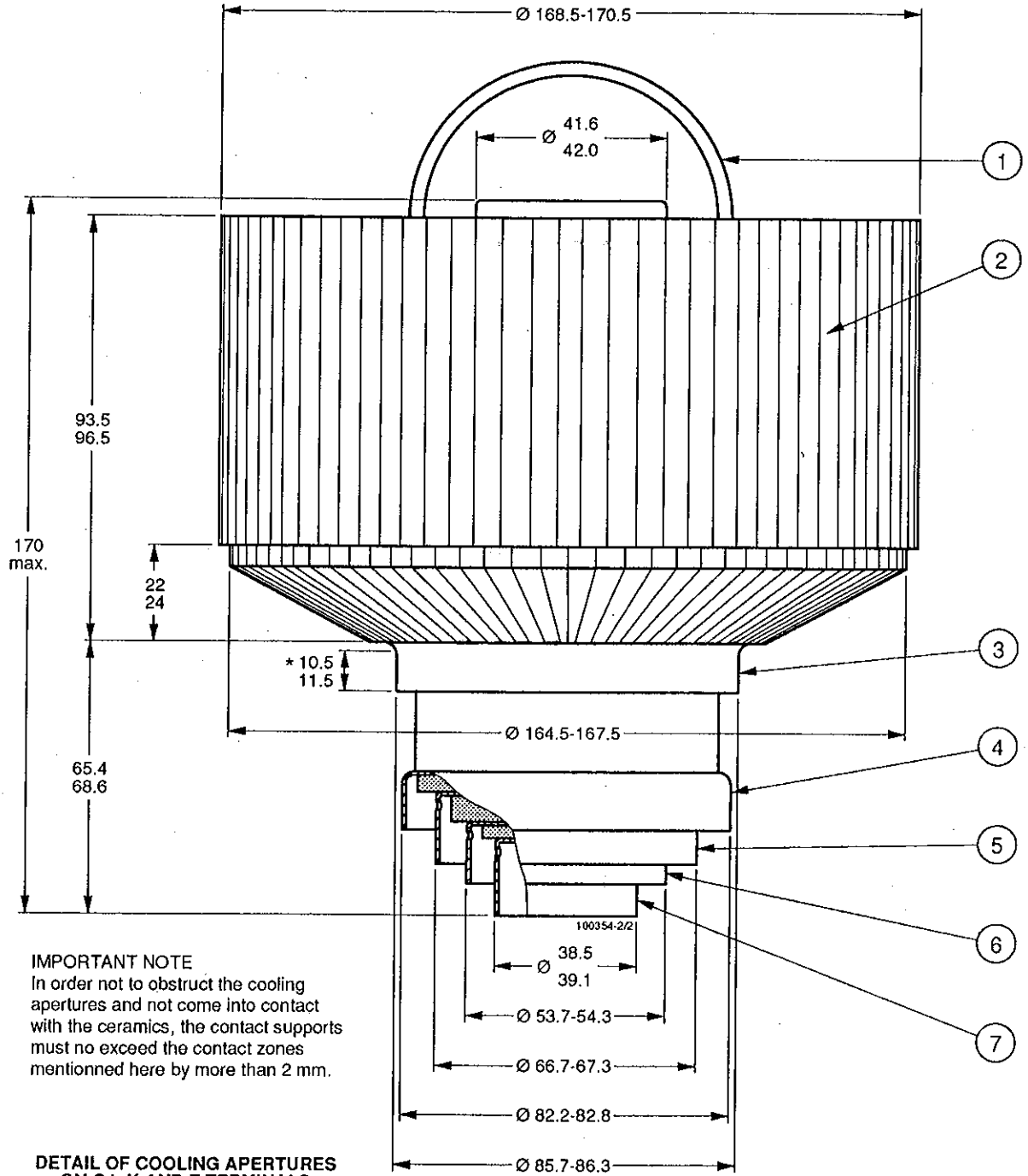
Monitoring Device for Overtemperature of Outlet Cooling Air

The temperature of the outlet air coming from the anode cavity must not exceed 100 °C. This temperature rises when the cavity is not properly adjusted. A monitoring device must be provided to warn the user of improper adjustment. On the other hand, this device allows the user to check that the air evacuation system (generally supplied by the user) is well adapted to the equipment.

CONSTANT-CURRENT CHARACTERISTICS
Vg2 = 600 V

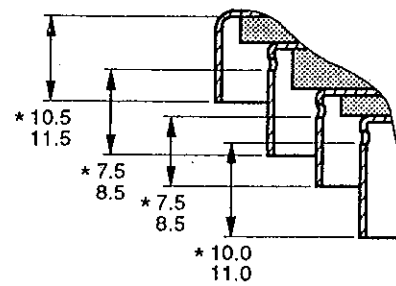


OUTLINE DRAWING



IMPORTANT NOTE
In order not to obstruct the cooling apertures and not come into contact with the ceramics, the contact supports must no exceed the contact zones mentionned here by more than 2 mm.

DETAIL OF COOLING APERTURES ON G1, K AND F TERMINALS



1. Hinged handle
2. Radiator
3. Anode
4. Screen grid (g2)
5. Control grid (g1)
6. Filament - cathode
7. Filament

* Contact zones

Dimensions in mm